Appendix A

Sample and Analysis Plan Tables

Plan Table Number: CFA10-PRE

SAP Number:

Date: 04/02/2001 Plan Table Revision: 6.0 Project: CFA-10 PRE-REMEDIATION SAMPLING Project Manager: WILLIAMS, H. D. SMO Contact: KIRCHNER, D. R.

Sample Description					Planned Date	Sample Location				Enter Analysis Types (AT) and Quantity Requested																					
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method		Area	Location	Type of Location	Depth (ft)	BE	LD	TI																	
413001	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 1	TRANSFORMR YARD	0.0 - 0.50		1	1																	
413002	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 1	TRANSFORMR YARD	1.0 - 1.25	1	1																		
413003	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 2	TRANSFORMR YARD	0.0 - 0.50		1	1																	
413004	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 2	TRANSFORMR YARD	1.0 - 1.25	1	1																		
413005	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 3	TRANSFORMR YARD	0.0 - 0.50	1	1																		
413006	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 4	TRANSFORMR YARD	0.0 - 0.50	1	1																		
413007	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 5	TRANSFORMR YARD	0.0 - 0.50		1	1																	
413008	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 5	TRANSFORMR YARD	1.0 - 1.25	1	1																		
413009	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 6	TRANSFORMR YARD	0.0 - 0.50		1	1																	
413010	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 6	TRANSFORMR YARD	1.0 - 1.25	1	1																		
413011	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 7	TRANSFORMR YARD	0.0 - 0.50	1	1																		
413012	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 8	TRANSFORMR YARD	0.0 - 0.50	1	1																		
413013	REG/QC	SOIL	DUP		04/11/2001	CFA-10	SECTION 9	TRANSFORMR YARD	0.0 - 0.50		2	2																	
413014	REG	SOIL	COMP		04/11/2001	CFA-10	SECTION 10	TRANSFORMR YARD	BELOW PAD	1	1																		
413015	REG	CONCRETE	CORE		04/11/2001	CFA-10	SECTION 10	TRANSFORMR YARD	DEPTH OF PAD	1																			

The sampling activity displayed on this table represents the first six characters of the sample identification number. The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: TCLP Lead

AT2: Lead

AT3: TCLP Metals

AT4:

AT5:

AT6:

AT7:

AT8:

AT9:

AT10:

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Note: Only the middle location of the concrete pad, Section 10, will be submitted for TCLP analysis.

TCLP Metals = TCLP Lead, TCLP Cadmium, and TCLP Chromium

Analysis Suites:

Contingencies:

Plan Table Number: CFA10-PRE

SAP Number:

Date: 04/02/2001 Plan Table Revision: 6.0 Project: CFA-10 PRE-REMEDIATION SAMPLING Project Manager: WILLIAMS, H. D. SMO Contact: KIRCHNER, D. R.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																					
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Location	Type of Location	Depth (ft)	BE	LD	TI																	
413016	QC	WATER	RNST		04/11/2001	CFA-10	QC	EQUIP RINSATE	NA		1																		

The sampling activity displayed on this table represents the first six characters of the sample identification number. The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: TCLP Lead

AT2: Lead

AT3: TCLP Metals

AT4:

AT5:

AT6:

AT7:

AT8:

AT9:

AT10:

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Note: Only the middle location of the concrete pad, Section 10, will be submitted for TCLP analysis.

TCLP Metals = TCLP Lead, TCLP Cadmium, and TCLP Chromium

Analysis Suites:

Contingencies:

Plan Table Number: CFA10-POST

SAP Number: DOE/ID-10857

Date: 06/13/2001 Plan Table Revision: 6.0 Project: CFA-10 POST-REMEDIATION SAMPLING Project Manager: S. G. WILKINSON SMO Contact: KIRCHNER, D. R.

Sample Description					Planned Date	Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method		Area	Location	Type of Location	Depth (ft)	BE	LD	UC																		
413100	REG	SOIL	GRAB		07/01/2001	CFA-10	1	TRANSFORMR YARD	SURFACE		1																			
413101	REG	SOIL	GRAB		07/01/2001	CFA-10	2	TRANSFORMR YARD	SURFACE		1																			
413102	REG	SOIL	GRAB		07/01/2001	CFA-10	3	TRANSFORMR YARD	SURFACE		1																			
413103	REG/QC	SOIL	DUP		07/01/2001	CFA-10	4	TRANSFORMR YARD	SURFACE		2																			
413104	REG	SOIL	GRAB		07/01/2001	CFA-10	5	TRANSFORMR YARD	SURFACE		1																			
413105	REG	SOIL	GRAB		07/01/2001	CFA-10	6	TRANSFORMR YARD	SURFACE		1																			
413106	REG	SOIL	GRAB		07/01/2001	CFA-10	7	TRANSFORMR YARD	SURFACE		1																			
413107	REG	SOIL	GRAB		07/01/2001	CFA-10	8	TRANSFORMR YARD	SURFACE		1																			
413108	REG	SOIL	GRAB		07/01/2001	CFA-10	9	TRANSFORMR YARD	SURFACE		1																			
413109	REG	SOIL	GRAB		07/01/2001	CFA-10	10	TRANSFORMR YARD	SURFACE		1																			
413110	REG	SOIL	GRAB		07/01/2001	CFA-10	11	TRANSFORMR YARD	SURFACE		1	1																		
413111	REG	SOIL	GRAB		07/01/2001	CFA-10	12	TRANSFORMR YARD	SURFACE		1																			
413112	REG/QC	SOIL	DUP		07/01/2001	CFA-10	13	TRANSFORMR YARD	SURFACE		2																			
413113	REG	SOIL	GRAB		07/01/2001	CFA-10	14	TRANSFORMR YARD	SURFACE		1																			
413114	REG	SOIL	GRAB		07/01/2001	CFA-10	15	TRANSFORMR YARD	SURFACE		1	1																		

The sampling activity displayed on this table represents the first six characters of the sample identification number. The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: TCLP Lead

AT2: Lead

AT3: Cadmium

AT4:

AT5:

AT6:

AT7:

AT8:

AT9:

AT10:

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Cadmium = TCLP Cadmium

Analysis Suites:

Contingencies:

Plan Table Number: CFA10-POST

SAP Number: DOE/ID-10857

Date: 06/13/2001 Plan Table Revision: 6.0 Project: CFA-10 POST-REMEDIATION SAMPLING Project Manager: S. G. WILKINSON SMO Contact: KIRCHNER, D. R.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Location	Type of Location	Depth (ft)	BE	LD	UC																	
413115	REG	SOIL	GRAB		07/01/2001	CFA-10	16	TRANSFORMR YARD	SURFACE		1																		
413116	REG	SOIL	GRAB		07/01/2001	CFA-10	17	TRANSFORMR YARD	SURFACE		1																		
413117	REG	SOIL	GRAB		07/01/2001	CFA-10	18	TRANSFORMR YARD	SURFACE		1																		
413118	REG	SOIL	GRAB		07/01/2001	CFA-10	19	TRANSFORMR YARD	SURFACE		1																		
413119	REG	SOIL	GRAB		07/01/2001	CFA-10	20	TRANSFORMR YARD	SURFACE		1																		
413120	REG	SOIL	COMP		07/01/2001	CFA-10	SOIL PILE	TRANSFORMR YARD	NA	1		1																	
413121	QC	WATER	RNST		07/01/2001	CFA-10	QC	EQUIP RINSATE	NA		1																		

The sampling activity displayed on this table represents the first six characters of the sample identification number. The complete sample identification number (10 characters) will appear on field guidance forms and sample labels.

AT1: TCLP Lead

AT2: Lead

AT3: Cadmium

AT4:

AT5:

AT6:

AT7:

AT8:

AT9:

AT10:

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Cadmium = TCLP Cadmium

Analysis Suites:

Contingencies:

Appendix B

Random Sample Location Coordinates

Appendix B
Random Sample Location Coordinates

Table B-1. Preremediation sampling locations.

Sample No	X Coordinate (Easting)	Y Coordinate (Northing)	Sample No	X Coordinate (Easting)	Y Coordinate (Northing)
01	294675.33	678826.30	17	294787.47	678835.21
02	294686.24	678840.05	18	294806.30	678840.16
03	294695.16	678852.53	19	294769.42	678809.27
04	294713.60	678761.20	20	294784.30	678801.55
05	294725.69	678777.25	21	294801.15	678787.48
06	294737.58	678793.09	22	294799.96	678806.70
07	294762.03	678824.51	23	294816.41	678831.85
08	294772.93	678840.35	24	294819.58	678813.63
09	294784.63	678856.59	25	294742.85	678734.64
10	294720.06	678751.68	26	294761.89	678761.58
11	294744.25	678773.07	27	294762.88	678737.61
12	294741.67	678753.85	28	294751.98	678787.33
13	294751.58	678808.12	29	294767.05	678776.43
14	294767.05	678796.44	30	294781.32	678765.54
15	294782.91	678784.36			
16	294787.66	678816.20			

Table B-2. Postremediation sampling locations.

Sample No	Y Coordinate (Northing)	X Coordinate (Easting)	Sample No	Y Coordinate (Northing)	X Coordinate (Easting)
01	678851.90	294692.73	11	678833.16	294761.31
02	678757.50	294716.25	12	678814.74	294767.52
03	678736.39	294728.29	13	678793.63	294779.56
04	678789.01	294728.14	14	678772.53	294791.61
05	678769.54	294737.35	15	678847.89	294776.57
06	678748.44	294749.40	16	678826.78	294788.62
07	678727.33	294761.44	17	678805.68	294800.67
08	678802.69	294746.41	18	678857.39	294796.87
09	678781.59	294758.46	19	678838.83	294809.72
10	678760.48	294770.5	20	678817.73	294821.77

Appendix C

Statistical Summary

Appendix C
Statistical Summary

This appendix summarizes the method and rationale for determining the number of samples required for the CFA-10 Transformer Yard verification sampling.

OBJECTIVE

The objective of this sampling effort is to determine the number of samples that are required to statistically support, with a high degree of confidence, that the CFA-10 remedial action has met the cleanup goals.

EVALUATION OF PAST DATA

Past sampling efforts have identified that the majority of lead contamination is present in surface soils (0 to 6 inches). Verification sampling will occur following excavation of six inches and possibly up to a foot of soils from the Transformer Yard. Therefore, an evaluation was performed on the Track 2 (1995) and Remedial Investigation/Feasibility Study (RI/FS) (1997) data for lead concentrations below 0.5 ft. Although limited in the number of samples, these data provide some information regarding lead contamination below 0.5 ft. These data indicated that the lead concentrations were well below the project cleanup goal of 170 mg/kg and the final remediation goal of 400 mg/kg with an average concentration of 39 mg/kg and a maximum concentration of 88 mg/kg. These results also identified a coefficient of variation of approximately 1. The coefficient of variation is a quantity that measures the amount of variability relative to the value of the mean (standard deviation/average).

FORMULA FOR DETERMINING SAMPLE SIZE

The number of samples needed for verification sampling at the Transformer Yard was identified using the "Formulae for Calculating the Sample Size Needed to Estimate the Mean" (EPA 230/2-89/042).

$$n_d = \sigma^2 \left[\frac{z_{1-\beta} + z_{1-\alpha})}{(Cs - \mu_1)} \right]^2$$

n_d = Number of samples

Cs= Cleanup standard

α = false positive rate (0.05)

β = FALSE NEGATIVE (0.05)

μ_1 = mean declared as site being clean

σ = standard deviation

The formula was applied based on a cleanup standard (Cs) of 170 mg/kg. When applying past data results to the unknown variables μ_1 and σ at a 95% level of confidence ($\alpha = 0.5$ and $\beta = 0.5$), the resulting sample size was < 1. This size was unreasonably small for verification sampling; therefore, a modified approach was taken to determine a more appropriate number of samples. This modified approach maintained all the variables, with the exception of μ_1 (=127.5), which was set at 75% of the Cs, and σ (=57), which was set at 1/3 the Cs. This assumption was deemed conservative because, following excavation, lead concentrations are expected to be well below the cleanup standard of 170 mg/kg and below the calculated value for μ of 127.5 mg/kg. In addition, the standard deviation is deemed conservative, based on past sample data. Selection of these values involved use of judgement and evaluation of the appropriateness of the resultant sample size. A summary of these approaches is provided in the table below.

Application of this modified approach identifies that 20 verification samples are required to statistically support that the site was cleaned to below the cleanup goal with a 95% level of confidence. This number is believed to be reasonable, based on past data evaluations, conservative estimates, and experience.

	Cs	μ_1	σ	$Z_{1-\alpha}$ ($\alpha = 0.05$)	$Z_{1-\beta}$ ($\beta = 0.05$)	n_d
Past Data Approach	170	38.5	30.4	1.645	1.645	< 1
Modified Approach	170	127.5	57	1.645	1.645	19.5

SAMPLE LOCATIONS

The proposed sampling is intended to support compliance with cleanup goals at CFA-10; therefore, uniform coverage over the area is desirable, as is an equal likelihood of sampling any location. Consequently, a random systematic design is proposed with placement of a grid at a randomly-selected start point and oriented in a randomly selected direction. Grid spacings were determined by the below formula.

$$\text{Grid spacing} = (SA/n)^{1/2}$$

where, SA = surface area (11,800 ft^2)

n = number of samples (20)

The grid spacing is 24.3 ft. Sampling locations are identified in Figure 4-2, and northing and easting coordinates are in Appendix A.

TOTAL NUMBER OF SAMPLES

The proposed approach will follow the QAPjP guidelines and include collection of duplicate and equipment rinsates samples 1 per 20 samples or once a day. Because CFA-10 is not classified as a radiologically contaminated site, no field blanks are required.